

TITLE OF THE INVENTION

CARD SLOT UNIT FOR PORTABLE DIGITAL EQUIPMENT

CROSS-REFERENCE TO RELATED APPLICATIONS

5 This application is based upon and claims the benefit of priority from the prior Japanese Patent Application No. 2003-023872, filed January 31, 2003, the entire contents of which are incorporated herein by reference.

BACKGROUND OF THE INVENTION

10 1. Field of the Invention

The present invention relates to a card slot unit generally used in portable digital equipment, and more particularly to an internal structure of a card slot.

2. Description of the Related Art

15 In recent years, as portable digital equipment such as personal computers and personal digital assistants (PDAs), those which can use a card module (including a so-called IC card) such as a memory card or a wireless communication card are becoming common.

20 As a card module, a circuit module such as a memory or an integrated circuit is mounted in a card-like case. Further, a plurality of card terminals connected to the circuit module are mounted on a surface of the case usually by using a printed
25 circuit structure.

On the other hand, a card slot used to mount the card module is provided on a main body of a digital

equipment. The card slot is a case to/from which
the card module can be attached/detached, and has
connectors which are brought into contact with and
electrically connected with each card terminal of
5 the card module. The main body of the digital
equipment has a card interface circuit connected to
the connectors of the card slot, and is electrically
brought into contact with the attached card module.

Meanwhile, usually, the card terminals are
10 mounted on only one plane of a front surface or a back
surface of the card module. Therefore, when a user
accidentally attaches the card to the card slot with
the sides reversed (so-called reverse insertion), there
occurs a status that the card terminals of the card
15 module and the connectors of the card slot are not
connected to each other.

As a prior art which can solve such a problem,
there has been proposed a slot unit which can be
normally used even if the memory card is attached in
20 the reverse insertion state (see, e.g., Japanese patent
application laid-open No. 2002-56909).

The slot unit of the prior art has connectors
(slot connectors) which are opposed to each of the both
sides of the memory card, and is constituted in such
25 a manner that the card terminals and the slot
connectors can be normally connected to each other even
if the memory card is attached with either of the sides

turned up. Therefore, even if the so-called reverse insertion state mentioned above occurs, the memory card can be caused to normally function.

5 In such a slot unit of the prior art, however, when the memory card is not attached, the opposed respective slot connectors are connected to each other. A malfunction may possibly be generated in a circuit operation in the card interface circuit of the digital equipment when the respective slot connectors of the
10 slot unit are connected to each other.

BRIEF SUMMARY OF THE INVENTION

In accordance with one embodiment of the present invention, there is provided a card slot unit including connector members with a reversible connector and
15 an insulator for preventing a short circuit between the connector members.

The card slot unit comprises: first and second slot connectors which are provided on respective planes of an internal space in such a manner that they are in
20 contact with and electrically connected with card terminals mounted on one plane of a card module in the internal space which detachably accommodates the card module therein; and an insulating member which is positioned between the first and second slot connectors
25 when the card module is not attached to prevent a contact between the first and second slot connectors.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate embodiments of the invention, and together with the general description given above and the
5 detailed description of the embodiments given below, serve to explain the principles of the invention.

FIG. 1 is a cross-sectional view showing a basic structure of a card slot concerning a first embodiment
10 of the present invention;

FIG. 2 is a cross-sectional view showing a structure of a reversible connector in the structure of the same card slot;

FIG. 3 is a cross-sectional view showing a structure of the card slot concerning the first
15 embodiment;

FIGS. 4 and 5 are cross-sectional views showing a structure of a card slot concerning a second embodiment;

20 FIG. 6 is a view showing an exterior appearance of a card slot concerning each embodiment;

FIGS. 7A and 7B are views showing the exterior appearance of the card module concerning each embodiment;

25 FIGS. 8A and 8B are views showing an exterior appearance of a digital equipment concerning each embodiment; and

FIG. 9 is a perspective view showing the structure of the card slot concerning the first embodiment.

DETAILED DESCRIPTION OF THE INVENTION

Embodiments according to the present invention
5 will now be described hereinafter with reference to the accompanying drawings.

(First Embodiment)

FIGS. 3 and 9 are views showing a structure of a card slot according to a first embodiment. FIG. 3
10 shows a structure having an insulator 30 which prevents a short circuit between connectors.

Here, a structure of the card slot from which the insulator 30 is eliminated will be described with reference to FIGS. 1, 2 and 6.

15 A main body 10 of the card slot has an insertion opening 11 from which a card module 100 (which will be simply referred to as a card hereinafter) such as a memory card is inserted and an internal space 12 as shown in FIGS. 1, 2 and 6. As shown in FIG. 2,
20 a plurality of slot connectors 13A and 13B consisting of leaf spring members (metallic elastic members) are provided in the internal space 12.

Here, as shown in FIG. 1, when the card 100 is attached in the internal space 12 of the card slot 10,
25 it is assumed that a direction in which a surface of the card 100 having terminals (which will be notated as card terminals) mounted thereon is set relatively

downward is a normal direction.

When the card 100 is attached in this normal direction, the plurality of connectors 13A provided in the slot come into contact with the plurality of card terminals on the card 100. The plurality of connectors 13B arranged so as to face these connectors 13A will be referred to as reversible connectors for the sake of convenience.

That is, as shown in FIG. 1, when the card 100 is attached in the normal direction, the reversible connectors 13B are in contact with a back side of the card 100 (plane on which the card terminals are not mounted).

Further, the card slot 10 is incorporated in digital equipment 200 such as a PDA. As shown in FIG. 1, the respective connectors 13A and 13B of the card slot 10 are connected to a card interface unit provided in the digital equipment 200. The card interface unit transmits/receives various kinds of input/output signals to/from the card 100 attached in the card slot 10 through the card terminals and the respective connectors 13A and 13B.

Specifically, as shown in FIG. 7A, the card 100 has a plurality of card terminals 110 mounted on one plane thereof by printed wirings. FIG. 7B shows the other plane of the card 100.

Specifically, as shown in FIG. 8A, the digital

equipment 200 is a PDA including a display portion 220
or an operation key 230 on one surface side of a main
body. FIG. 8B shows the other surface side of the PDA
main body. On the other surface side are incorporated
5 the card slot 10 of this embodiment together with
a battery cover 240.

The PDA 200 comes into contact with the card 100
attached in the card slot 10, and it is used to save
various kinds of data if the card 100 is, e.g.,
10 a memory card. Furthermore, if the card 100 is, e.g.,
a wireless communication card, the PDA 200 performs
wireless data communication with the outside through
the card 100.

(Structure of Insulator 30)

15 When the card 100 is ejected from the card
slot 10, the respective connectors 13A and 13B may be
possibly come into contact with each other and be
electrically short-circuited as shown in FIG. 2.

Thus, as shown in FIG. 3, the card slot 10 of this
20 embodiment has an insulator 30 used to prevent a short
circuit between the respective connectors 13A and 13B.
As shown in FIG. 9, the insulator 30 is a plate-like
member consisting of an electrically insulating
material, and configured to slide (move) in the same
25 direction as the attachment/detachment direction of
the card 100.

It is to be noted that FIG. 9 is a view showing

a partial external appearance of the card slot 10 depicted in FIG. 3. That is, a plane portion on which the connector 13B is provided (e.g., upper surface side) is eliminated in FIG. 9.

5 As shown in FIG. 3, one end portion of the insulator 30 is arranged in the card slot 10, and the other end portion of the same is pressed in the inner direction of the slot 10 by a spring member 31 arranged outside the card slot 10. That is, when the card 100
10 is inserted into the card slot 10, the insulator 30 comes into contact with the end portion of the card 100 and is pushed to the outer side of the card slot 10.

 When the card 100 is completely attached in the card slot 10, the end portion of the insulator 30 is
15 pushed out from the internal space 12 of the slot 10 (see FIG. 4). This is the state that the card 100 enters between the respective connectors 13A and 13B and the card terminals 110 are in contact with the connector 13A.

20 Here, when the card 100 is attached in the reverse insertion state in such a manner that the surface of the card 100 having the card terminals 110 mounted thereon is set relatively upward, the card 100 enters between the respective connectors 13A and 13B, and the
25 card terminals 110 and the reversal connectors 13B come into contact with each other (see FIG. 5).

 On the other hand, when the card 100 is ejected

from the card slot 10, the insulator 30 is no longer pressed by the card 100, and it slides (moves) to the inner side of the card slot 10 by the impetus of the spring member 31. When the card 100 is completely ejected from the inside of the card slot 10, the insulator 30 enters between the respective connectors 13A and 13B (see FIG. 3). Therefore, the insulator 30 is placed between the respective connectors 13A and 13B in accordance with ejection of the card 100 to prevent a short circuit which occurs when the respective connectors 13A and 13B come into contact with each other.

In short, if the structure of the card slot 10 according to the first embodiment is adopted, when the card 100 is not attached in the slot 10, the insulator 30 enters between the respective slot connectors 13A and 13B inside the slot, thereby preventing a short circuit which occurs when the respective connectors 13A and 13B come into contact with each other. Therefore, since a short circuit between the respective connectors 13A and 13B can be prevented, it is possible to avoid the problem that a malfunction occurs in the circuit operation of the card interface unit of the digital equipment 200.

Moreover, when the card 100 is completely attached in the slot 10, the insulator 30 is pushed to the outer side of the card 100. Therefore, the card 100 enters

between the respective connectors 13A and 13B, and the card terminals 110 and the slot connectors 13A are brought into contact and connected with each other.

As a result, the card 100 is connected with the card interface unit of the digital equipment 200.
On the other hand, when the card 100 is attached in the slot 10 in the reverse insertion manner, the card terminals 110 come into contact with the slot connectors 13B, and the card 100 is connected with the card interface unit of the digital equipment 200.
(Second Embodiment)

FIGS. 4 and 5 are views showing a structure of a card slot 10 according to a second embodiment of the present invention.

This embodiment relates to a structure in which a movement mechanism (slide mechanism) of the insulator 30 is engaged with an eject mechanism. The eject mechanism has rod-shaped operation member 40 consisting of a metal or an insulating material and a rotation mechanism 41 which engages with both the operation member 40 and the insulator 30.

The operation member 40 is configured to slide (move) in the same direction as the attachment/detachment direction of the card 100, and it slides in the direction opposite to the insulator 30. An operation of the eject mechanism will be described hereinafter with reference to FIG. 4.

When the card 100 is inserted into the card slot 10, the insulator 30 comes into contact with the end portion of the card 100 and is pushed to the outer side of the card slot 10. When the card 100 is completely attached in the card slot 10, the end portion of the insulator 30 is pushed out from the internal space 12 of the slot 10. This is the state that the card 100 enters between the respective slot connectors 13A and 13B and the card terminals 110 are in contact with the slot connectors 13A.

At this time, the end portion of the insulator 30 placed on the outer side of the slot 10 rotates the rotation mechanism 41. The operation member 40 is moved so as to slide in the direction of the insertion opening 11 of the slot 10 by this operation of the rotation mechanism 41. Therefore, the end portion of the operation member 40 protrudes from the slot 10.

On the other hand, in order to take out the card 100 from the slot 10, the operation member 40 is pushed in the inner direction of the slot 10. By this operation, the end portion of the operation member 40 rotates the rotation mechanism 40 in the direction opposite to the former direction. The insulator 30 slides (moves) to the inner side of the card slot 10 by this operation of the rotation mechanism 41.

Therefore, the insulator 30 acts so as to push out the card 100 in the direction of the insertion

opening 11 from the inside of the card slot 10.

The insulator 30 enters between the respective connectors 13A and 13B (see FIG. 3). Accordingly, the insulator 30 is placed between the respective
5 connectors 13A and 13B, thereby preventing a short circuit from occurring when the respective connectors 13A and 13B come into contact with each other. In this state, the card 100 is distanced from the respective connectors 13A and 13B and it can be taken out by
10 the user.

FIG. 5 shows the case that the card 100 is attached in the slot 10 in the reverse insertion manner. In this case, the card 100 enters between the respective connectors 13A and 13B, and the card
15 terminals 110 are in contact with the slot connector 13B for the reverse insertion. In this case, like FIG. 4, by operating (pushing out) the operation member 40, the card 100 can be likewise ejected from the card slot 10 by interlocking of the rotation mechanism 41
20 and the insulator 30.

In short, if the structure of the card slot 10 according to the second embodiment is adopted, by operating (pushing out) the operation member 40 of the eject mechanism when the card 100 is being attached in
25 the slot 10, the card 100 can be ejected from the card slot 10 by interlocking of the rotation mechanism 41 and the insulator 30. In this case, the insulator 30

enters between the respective slot connectors 13A and 13B in the slot 10, and a short circuit can be prevented from occurring due to a contact between the respective connectors 13A and 13B.

5 Therefore, if the structure of this embodiment is adopted, the insulator 30 functions as a constituent element of the eject mechanism for the card 100 and also as an element which prevents a short-circuited state between the respective connectors 13A and 13B in
10 the slot 10.

 As described above, according to this embodiment, when the card module is not attached in the card slot having the reversible connectors, it is possible to avoid a state that the respective slot connectors are
15 short-circuited. Since applying the card slot having such a structure to a digital equipment can prevent a short circuit from occurring due to a contact between the respective connectors in the card slot, it is possible to avoid occurrence of a malfunction in the
20 card interface unit or the like in the digital equipment in particular.

 Additional advantages and modifications will readily occur to those skilled in the art. Therefore, the invention in its broader aspects is not limited to
25 the specific details and representative embodiments shown and described herein. Accordingly, various modifications may be made without departing from

the spirit or scope of the general invention concept as defined by the appended claims and their equivalents.